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FOREWORD

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SELECTED MILITARY TRANSLATIONS ON EASTERN EUROPE

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THE DEFENSE AND PROTECTION OF TRANSPORT IN PRESENT-DAY MILITARY OPERATIONS

[Following is a translation of an article by A. Wolosiewicz in Przeglad samochodowy (Automobile Review), Vol XII, No 4, April 1959, Warsaw, pages 6-19.]

The characteristic traits of contemporary military operations, which include, among others, the enormous striking force of military units provided with means of mass destruction, increased maneuverability, the presence of a huge amount of technical equipment, etc., prove that the very character of the defense and protection of troops, as well as automobile technology, has undergone considerable changes in comparison with the past. For this reason, the problems raised in the present article are offered as food for discussion, during which it will be possible to develop and crystallize certain questions merely touched upon here.

We know from military history that after each operation, each battle, the means and weapons employed have been re-evaluated and perfected. It is sufficient to point to the battles waged in the past decade in the Near and Far East, which often served as testing grounds for their Western promoters.

It was in accordance with one of the basic laws of physics (Newton's law of "action and reaction") that modern methods of defending and protecting personnel and their equipment came into being. These methods, however, fall short of the power and destructive capabilities of present-day weapons of mass destruction and constitute only a partial solution, often based on old forms and methods. To explain this line of reasoning, it is necessary to point out that future military operations may embrace all possible methods of warfare on land, at sea, and in the air, closely combining atomic weapons with highly-developed classic (conventional) weapons. This will create a situation in which many elements of the defense and protection of personnel and materiel will either satisfy former requirements or will undergo partial improvement. It may be that in some sectors we shall see the introduction of new methods of defense and protection which will be developed simultaneously with the advancement of technological and military theory.

The defense and protection of mechanized vehicles and automotive equipment is organized for the following purposes:

- (a) to assure the safety of personnel and equipment;
- (b) to assure the full and continuous technical and military efficiency of mechanized vehicles, which represent one of the vital elements of units (tactical groups) in the process of carrying out military operations;

to assure the normal operations of repair, evacuation, and supply units (installations) by protecting them against attack by diversionary groups, landing parties, etc.

In present-day military operations, defense and protection will be provided for such areas far in the rear as could also be the objects of diversionary attack, especially by aircraft or atomic weapons and missiles. I do not mean that the repair or supply units of the automotive service will constitute a direct objective of an atomic attack. Nevertheless, the areas in which they are dispersed could be located in a strategically or operationally important zone which could consequently expose them to the direct threat of an atomic attack.

The defense and protection of automotive transport and materiel depends essentially on the specific organization and execution of appropriate measures to assure against enemy attack. The defense and protection of technical materiel can be divided into two types, according to the nature of the operations carried out and the tasks realized.

Passive defense covers preliminary operations such as camouflage, digging in, the manner of moving in column formations, and various other operations designed to lessen the degree to which the enemy can ascertain quartering sites and determine the intentions and methods of our forces. All are aimed at keeping down the loss of personnel and equipment.

Active defense relates to fighting off the enemy with the available men and firepower, as well as maintaining constant guard and patrol duty.

The defense and protection of technical materiel may be subdivided according to the nature of the fighting involved: for example, anti-atomic, anti-aircraft, anti-chemical, anti-bacteriological, anti-incendiary, anti-diversionary, anti-landing, anti-armor, etc. But each of the separate types of weapons will be used in close combination with others, thus bringing into play the specific characteristics of each. For instance, an anti-diversionary weapon will be used along with anti-incendiary and anti-bacteriological weapons, etc. Motorized equipment, nevertheless, will always be a tempting target for the enemy, since the liquidation of such would restrict the ability of other types of weapons and services to fulfill their missions.

In present-day military operations the most difficult, complicated, and responsible task is organizing and maintaining anti-atomic defense. That is why I believe this should be the preliminary step in working out any plan for other types of defense, the more so since the use of an atomic weapon would inevitably set the course of military operations.

Success in organizing anti-atomic defense may be achieved if all personnel are acquainted with anti-atomic defense requirements and the ways and means of negating the results of an atomic attack, and if the men also have courage and initiative, as well as a high sense of discipline and devotion to country.

In organizing the defense and protection of automotive materiel, one must constantly bear in mind the dangers of atomic explosions to which personnel and materiel are exposed -- the impact wave, flash radiation, and penetrative radiation. Various factors affecting the protection of automotive transport in basic types of fighting should be examined from this standpoint.

Protective Measures Against Atomic Attack

The impact wave of an atomic explosion is similar to the impact wave of an ordinary explosion, but it is characterized by a considerably greater force. The duration of an impact wave possessing maximal destructive force is limited to a few seconds; nevertheless, it spreads with very great speed, as illustrated in the following table:

COURSE OF AN EXPLOSION ON THE SURFACE OF THE EARTH
OF A BOMB AT A HEIGHT OF 750 METERS

Distance from zero point in km.	Maximum speed of wind in km/hr.	Time of impact in sec.	Maximal impact of atm.
300	1300	0.37	2.4
600	900	0.45	1.6
900	600	0.62	1.1
1200	400	0.77	0.68
1500	300	0.90	0.56
2100	200	1.06	0.25
3000	110	1.20	0.14

The casualty range of personnel sheltered in fortified buildings is 4 to 9 times less than the casualty range of unprotected personnel. The impact wave represents a considerable danger to living organisms and to automotive materiel, especially if unsheltered, because of the wave's great dimensions and considerable height above the ground. The losses stem not only from the direct thrust but also from injuries inflicted by fragments of destroyed fortifications, buildings, uprooted trees, stones, earth, pieces of glass, etc., thrown around by the force of the impact wave.

Flash radiation: The wave of flash radiation energy is equal to the amount of energy falling in a unit of time upon one square centimeter of surface perpendicular to the direction from which the radiation comes. It is in inverse proportion to the square of the distance from the site of the explosion. At a distance of one kilometer from the site of the explosion in clear weather, this wave amounts to about 40 calories per square centimeter per second, that is, 1,000 times greater than the energy coming from the sun (maximum 0.03 calories per square centimeter per second).

During an atomic explosion, the radiation lasts for several seconds. It is so strong that even in a period of short-lived activity it can inflict serious burns on unprotected parts of the human body. For example, in the explosion in Japan burns were the cause of approximately 30 percent of the fatalities.

The table below shows approximate distances from the site of the explosion of a hypothetical atomic bomb resulting in various types of damage:

<u>MATERIAL</u>	<u>DAMAGES</u>	<u>GREATEST DISTANCE IN KM</u>
human skin	permanent burn	3.6
" "	secondary burn	3.1
white paper	chars	2.1
white paper	ignites	1.9
pinewood, dark	ignites	3.0
woolen clothing, dark	ignites	1.9

In an aerial explosion occurring in favorable weather (without clouds, snow, rain, fog, etc.), blinding effects may affect an area as much as 10 to 12 kilometers away for a period of several minutes in the daytime, and as long as 10 to 20 minutes at night, in the case of an atomic explosion with a force of about 20 kilotons.

Flash radiation also causes the combustion of flammable materials, and this is of special significance in studying the problems of protecting technical materiel, which should be included in the category of flammable materials.

Automotive materiel, especially if unprotected, is subject to strong flash radiation effects even at a distance of several kilometers from the zero point. Flammable objects coated with lubricants and cloth products such as tarpaulins and upholstery may burst into flame, while the wooden parts of equipment and weapons will be charred.

Light waves, like the rays of the sun, are emitted from a fiery ball and sent in straight lines. They do not penetrate opaque objects. That is why any obstacle such as the walls of buildings, the slopes of hills and mountains, armor, dense woods, and even textile materials protects individuals and flammable materials from direct flash radiation.

Penetrative radiation: Gamma rays and neutrons penetrate the human organism like X rays, and can even cause death within a radius of 1.5 to 2 kilometers if the radiation dose amounts to about 400-500 r. The table below shows approximate data pertaining to the effects of various doses of gamma rays on the human organism.

<u>DOSES IN ROENTGENS (R)</u>	<u>PROBABLE EFFECT</u>
0 - 25	Harmless
25 - 50	Possible changes in blood
50 - 100	Harmful, changes in blood
100 - 200	Harmful, possible work disability
200 - 400	Very harmful. Work disability. Possible death.
400	Causes death in 50% of all cases
600	Causes death in all cases

The effect of gamma rays on an organism depends not only on the amount of the dose but also on the duration of its action and the distance from the place of explosion (Fig. 1).

The harmful effects of penetrative radiation, as is the case with X rays, are explained by the fact that a large dose disturbs the normal functioning of the cells and causes sickness -- the so-called radiation sickness. The action of penetrative radiation considerably weakens the layers of various protective materials (Fig. 2).

As for technical materiel, the harm done by the action of gamma rays will depend, among other things, on their capacity to ionize the material through which they penetrate. The harm done by neutrons is even greater. If there is no electrical reaction, the neutrons can penetrate deep into various materials. They combine especially with the nuclei of such elements as manganese, sodium, cobalt, etc. As a result, some of these elements become radioactive and begin to disintegrate. For example, sodium influenced by neutron activity emits beta particles and gamma rays and becomes transformed into magnesium. The period of the partial disintegration of sodium (this element is widely distributed in nature, water, soil, organisms, etc.) is 14.8 hours.

The properties of some materials also may undergo changes under the influence of penetrative radiation. For example, glass darkens, film and paper sensitive to light acquire luminosity, etc.

Radioactive contamination of the ground depends on the objects covering it or found on it:

products of an atomic explosion (fragments of fissionable material, portions of nuclear fuel which failed to take part in the reaction), as well as dust from the bomb shell and other bomb parts all become radioactive bodies, due to the action of neutrons;

radioactive military materials which could be in the form of solutions, powders, smoke mixtures, etc., capable of emitting gamma rays, alpha particles, or beta particles. Modern science has not as yet developed any physical or chemical method of destroying or neutralizing radioactive military materials. Their effect can be diminished only by the physical removal of the materials.

In view of what is generally known about the characteristics of atomic explosions, we can develop certain concepts about the defense and protection of automotive materiel and personnel.

The extent of the destructive effect of an atomic explosion on personnel and materiel (as a basic means of mass destruction) depends on the following:

the type of atomic explosion (aerial, surface, underground or underwater);

the force of the atomic or thermonuclear bomb expressed in kilotons;

the method of deploying armies and materiel and the degree to which they are sheltered during an explosion;

the features and characteristics of the terrain;

the distance from the zero point (epicenter) of the explosion;

the army's skill in utilizing methods of anti-atomic defense, countering the effects of the atomic attack, etc.

The possibility of an atomic attack obliges us to accept the permanent principle that armies (groups, units, and even individual technical services) should be in constant readiness for anti-atomic defense, should be capable of independently undertaking (in their own sphere) any measures for their individual defense and for the defense of weapons and materiel entrusted to them. Protection can be guaranteed only by concealing all objects as deep in the ground as possible or in properly adapted shelters.

There is no doubt but that in the event of the use of an atomic weapon one aspect of the defense and protection of personnel and materiel in the field of battle will be a highly-developed warning network to sound the alert in case of the danger of an atomic attack. This will permit the initiation of steps to reduce losses among personnel and in materiel by earlier concealment of momentarily superfluous weapons and equipment in shelters and niches where they would be covered with fireproof mats, enforcement of protective measures, removal of soldiers to shelters, etc.

The next step in protection and defense is to measure continuously the degree of radiation, even if the atomic explosion occurs a considerable distance away. This will make it possible to protect soldiers (drivers and specialists) against injury from radioactive material. The measurement of radiation is of special significance as regards a march (movement of an army) whose path may run through a previously contaminated region. The results of radiation

will show up only after a certain lapse of time, depending on how long it persists in the contaminated region and the degree of contamination measured in roentgens.

It should be remembered that in the surface explosion of a hypothetical bomb, technical materiel--for example, trucks -- may be completely destroyed at a distance of 1,000 meters from the zero point. At a distance of 1,000 to 2,000 meters they will be slightly damaged, and beyond 3,000 meters there will be little damage or none at all. These losses will be greatly reduced in accordance with the extent and method of sheltering mechanized vehicles. This leads to the following propositions:

a. It is necessary to arrange for full concealment of personnel and materiel in all possible types of combat in conformity with the requirements applicable to stationary defense, that is:

utilization, for the protection of personnel and equipment, of various features of the terrain, ravines, undulations of the ground, woods, etc.;

in marching, fighting, or resting, the use, wherever possible, as a regular principle, of the dispersal of one's own troops (concentration of equipment), in order that the enemy may not find a suitable target for atomic attack. It is also necessary to maintain the constant combat readiness of independent units and sub-units; the endeavor by all means and under all circumstances to use dugouts for sheltering soldiers, weapons, and technical equipment, regardless of the length of stay in a given area;

constant reconnaissance to detect radioactivity and, in case of necessity, proper de-activation of personnel and equipment.

b. It is necessary to maintain at full efficiency all technical equipment and adequate means for the evacuation of the reserves which would be needed for liquidating the aftereffects of an atomic assault. This would tend to limit losses of personnel and equipment, especially at important places subjected to enemy operations, such as highway intersections, defiles, inhabited areas, cities, etc.

When assigning positions to units and detachments, as well as equipment, the dispersal should not be in the form of a circle but rather in the form of strips neither too long nor too broad (see Fig 3, 4, 5, and 6).

There is no doubt but that this will depend on many factors, such as the potentialities of the terrain, the organization of

defense, the organization of technological processes in repair shops, etc. However, the applied form of dispersal guarantees a reduction of losses, because the impact of the explosion of an atomic weapon diffuses (in principle) with equal force in all directions.

Another condition for all types of the defense and protection of technical equipment and personnel is the principle of dispersal in such areas as permit complete camouflage and natural cover.

If units (or equipment) are assigned to positions in inhabited areas (especially in the wintertime) or in forests, it is necessary to remember that these targets are especially attractive as regards air reconnaissance, radio location, by means of infrared rays and other modern optical means, permitting individual objects on the ground and all types of artificial camouflage to be detected, even from a considerable altitude.

It is also advisable to place units of specialists and their equipment not in the thick of a forest or in the center of inhabited areas but rather at the edge. This makes it possible in case of an atomic attack to remove them quickly from the threatened areas and to reduce losses resulting from fires, destroyed buildings, etc. It also facilitates the quick evacuation of contaminated areas.

It is clear that in selecting areas for quartering units of specialists which because of the nature of their work (e. g., maintenance and supply units) stay in one place longer than line units, it is necessary to avoid:

regions representing probable targets for atomic attack, such as industrial centers, large cities of political and economic importance, railroad bridges and bridges over large rivers, defiles, crossroads of the most important railroads, highways, etc.

During offensive operations and particularly when in pursuit, the tendency of advancing troops is to rush to maintain direct contact with the enemy. Motor vehicles of all kinds then play a predominant part. The maintenance of the full defense and protection of automotive equipment will depend, in these circumstances, on the following:

adroit and rapid movement of troops in columns (protected by scouts) in battle order or on the march, at the same time maintaining complete battle readiness and avoiding the bunching up of vehicles and traffic jams, which represent advantageous targets as regards attacks by atomic weapons, even those of the tactical type, or attacks by conventional weapons;

preservation of the full mechanical efficiency of all motor vehicles and their crews, so as to be capable at any moment of

maneuvering as required, regardless of terrain, atmospheric conditions, or the time of day or year; and in particular when taking a battlefield where both sides have employed weapons of mass destruction; and

and achievement by all technical personnel of greater efficiency in the use of the equipment assigned and in operating it under all conditions dictated by the military situation, as well as the skillful protection of themselves and their equipment by using all man-made or natural advantages of the terrain.

One way in which to assure the effective protection and defense of personnel and equipment in present-day military operations is to increase what is expected of the individual soldier with respect to the following:

the level and extent of his military knowledge, both general and technical;

personal characteristics, moral qualities, strength, will power, and bravery, as well as the creation of initiative and the ability to react immediately to any signals or orders;

and the belief in the righteousness of the struggle, in one's own strength, and manifestation of the will to win.

It is necessary to stress that in principle the organization of the appropriate anti-atomic defense fulfills at the same time most of the requirements for anti-aircraft, anti-chemical, and anti-artillery defense.

Means of Protecting Technical Equipment Against Fire

In present-day military operations a considerable percentage of losses in technical equipment (inflammable materials) may be caused by fires resulting from:

the action of thermal radiation during atomic (thermonuclear) explosions, aerial and artillery bombardment, unpiloted vehicles with atomic warheads, etc.;

use by the enemy of incendiary materials such as bombs released by aircraft, incendiary artillery and mortar shells, containers with incendiary fluids or substances (napalm, phosphorus), guided missiles, or even the activity of diversionary forces, etc.;

careless use of fire in the presence of inflammable materials, e. g., unprotected stoves in field kitchens, the exhaust pipes of combustion engines, ground wires in tanks, the flaming-up of improvised stoves, smoking (especially in dry coniferous forests).

The protection of equipment and personnel during fires in forests, inhabited areas, and fields overgrown with tall grass or dry grain is very difficult. It requires great effort, sacrifice, and considerable skill to put out a rapidly spreading fire. This is all the more true if fire-fighting is made more difficult by the following:

shelling (during an atomic attack);

lack of sufficient water and extinguishers;

possibility that disorganization may occur;

possible necessity of simultaneously fighting the enemy on the ground and in the air while putting out the fire, etc.

If a fire should break out, the first things to do are to determine its source and cause and the direction of the wind, to ascertain the direction and speed of the flames, and to get on with the job of steadily fighting the fire.

Small fires, e.g., burning phosphorus, napalm, and other common types, can be smothered with the aid of civilian fire-fighting equipment and any means at hand such as dry sand (earth, gravel), blankets, tents, etc.

Extinguishing fires spreading in several places, especially in forests, and arising from different points of origin is difficult and requires good organization and coordination of all efforts, the use of technical means including aircraft (helicopters), and so on. At the same time, it is necessary to evacuate all equipment from the threatened areas, while continuing to put up a good fight against the enemy. Considerable responsibility then falls upon the shoulders of all the technical personnel assigned to the equipment.

Fires can be extinguished in any of the following ways:

spraying and bombing the burning areas with substances which smother the flames;

creating firebreaks with earth or by chopping down a broad strip of trees in the path of the fire;

extinguishing the fire with water or extinguishers, establishing barriers with asbestos sheets, using such sheets to cover motor vehicles and other equipment, etc.

Fighting a fire requires all personnel to have courage and dedication and also a highly developed sense of direction because of the

restricted field of vision, difficulties of breathing, the high temperature of the surroundings, etc. Any hesitation in fighting the fire or any lack of coordination of efforts will fail to produce the desired results.

Every commander of a technical unit and every officer and soldier should constantly bear in mind what their duties are in fighting fires. It may be necessary to carry out these duties on a variety of terrains and under diverse battle conditions.

Means of Protecting and Servicing Technical Equipment

During Chemical and Bacteriological Attack

Poison gas and bacteria settling on technical equipment do not have an immediate reaction except in the case of very powerful chemical solutions (acids), which cause the corrosion or destruction of leather, textile, and wooden materials.

As a rule, contaminated vehicles, arms, or other equipment are the intermediate source of the contamination or infection of personnel (with epidemic diseases such as typhus, cholera, etc.), which immediately decides the outcome of the struggle.

Therefore efforts must be undertaken to decontaminate and disinfect equipment and arms if they are in a contaminated area. An effort must be made to wash off (neutralize) the contaminated parts with decontaminating or anti-bacterial solutions or with water, and afterwards with such fluids as gasoline, alcohol, etc. The order in which action is to be taken during decontamination and disinfection is similar to that during de-activation and is divided into partial and complete decontamination or disinfection, depending on the degree or nature of the poison gas or bacteria used.

Therefore, when occupying contaminated areas or engaging in decontamination or disinfection, all personnel operating equipment should be provided with individual chemical defense equipment (or special clothing). Cargo being transported must be tightly covered with canvas or other materials and subjected to tests.

In case of an alarm warning of atomic or chemical attack during a march, traffic should continue, depending on the decision of the commander of the column. Drivers and other technical personnel (mechanics and assistant drivers) should close up the cab of the vehicle and keep their places in the column. During a temporary halt they should put on their individual means of protection.

All elements of the column pulling off to the side of the march route must move forward on the orders of the commander of the

column. His decision will depend on the military situation, the features of the terrain, the nature of the orders he has received, etc.

In case of air attack during movement at a certain distance from the action on the front line, the elements of the column should either increase or decrease their speed as appropriate, and turn off onto side roads which permit the concealment of vehicles.

With respect to protection against bacteria, it should be emphasized that it is difficult to detect the presence of bacteria because of the absence of such devices as could be effectively used in the field. The following may be indications:

absence of radioactive materials and poisonous gases in the area where the projectiles or bombs have exploded;

presence of powders or drops of fluid on the surface of the ground and on equipment and vegetation in the vicinity of the explosion;

presence of insects, rodents, ;

encountering a large number of sick or dead animals.

Then reconnaissance patrols of the chemical and medical corps must be informed (or sent out) immediately, since the medical, veterinary, and chemical corps will be mainly the ones to investigate and combat means of biological warfare. However, all commanders of automotive units must remember that a vehicle can become--sometimes indirectly--the carrier of bacteria because of its frequent movement between different areas of military operations which may have been subjected to contamination, or because of having to transport the cargo necessary to sustain life or to wage battle and which to some degree may have been contaminated in transit or during storage.

All technical personnel, as well as other soldiers, should undergo thorough examination and preventive inoculations.

Means of Protecting Technical Equipment in Defense

Against Tanks, Diversionary Forces, and Paratroopers

Responsibility for the defense and protection of areas in which technical and automotive equipment is located is borne chiefly by the commander (quartermaster) in whose area a given automotive unit is present. The commanding officer of the automotive unit is obliged to make a "defense plan" before doing anything else.

In addition, he must systematically work out all plans, from the moment the area is reconnoitred, in order to be in the best

possible position to safeguard the men and equipment entrusted to him. He must also take into consideration that in present operations, with troops and equipment having considerable maneuverability, his outfit must be able to immediately organize its own defense until such time as help arrives.

The principal elements of the basic forms of ground defense, from the standpoint of possible usefulness to the automotive corps, will be mainly the disposition of technical, maintenance, reconnaissance, and evacuation units, or even individual vehicles, forming definite combat groups capable of fighting off sudden attacks.

The disposition of units should be carried out on the basis of circular defense (in the form of a ring), with sufficient firepower and observation, communication, and warning posts.

Protection and defense must be taken into consideration in assigning positions to equipment of considerable value such as trucks with special gear for inspection and repairs.

In assigning positions to technical units, one must observe the following principles, among others:

terrain features should be exploited for camouflage, protection, and defense, i.e., appropriate trenches for trucks, fire points, etc.

positions chosen for units should have natural obstacles such as rivers, lakes, swamps, and so on, in the direction of the enemy;

vehicles and technical installations should be dispersed as much as possible (but not so much as to hamper their work);

alarm cars, tractors for towing, fire-fighting equipment, combat vehicles, etc., should all be placed in areas permitting their immediate use.

Units of specialists employ the basic types of defense for ground forces and equipment:

organization of observation and communication services;

equipping and training personnel to fight armored forces, diversionists, and paratroopers;

maintenance of constant liaison with adjacent units at the front and in the rear;

organization along contemporary lines of saturation defense in accordance with the number of fire positions, etc.

After arrival at a new position, the commanding officer of a technical unit is expected to do the following:

a. work out a plan of defense and protection for the unit (area), taking into consideration:

use of the civilian and assigned manpower and equipment at his disposal;

assignment of special detachments in the area and in technical installations to defense in accordance with the position and the possibilities;

b. provide for the carrying out of engineering tasks (fire positions, anti-atomic shelters, etc.);

c. work out ways and means to liquidate the after-effects of an atomic or chemical attack, an air raid, or an attack by enemy ground forces; to organize the evacuation of the sick and wounded and damaged technical equipment and arms; to conduct medical de-activation efforts; firefighting; etc;

d. work out detailed instructions on how to suspend work and safeguard equipment in the event of an alarm, to use crews for the defense of ground areas, to assign units for fighting off the enemy. Or to create conditions of full security for work and for the operation of technical installations.

The foregoing indicates that the proper protection and defense of personnel and equipment depends primarily on accurate knowledge of the reasons for the occurrence of losses in present-day military operations, and on the creation of certain conditions for the purpose of limiting or eliminating these losses.

REMARKS ON THE ORGANIZATION OF AIR SUPPLIES

[Following is a translation of an article by Leslaw Dudek in Przeglad wojsk ladowych (Land Troops Review), Vol I, No 4, October 1959, Warsaw, pages 50-62]

It is a typical truism that military operations cannot be efficiently conducted without a good system of material-technical supply and service for troops fighting at the front. The validity of this thesis can be substantiated by numerous examples taken from wars waged in different historical periods and in various areas of the world. The last war sharpened this problem: contemporary, and to a considerable extent, motorized and mechanized troops, still depend in large measure on the rear.

In his book Crusade In Europe Eisenhower gives an excellent example of this. He maintains that the speed of the invading troops in the autumn of 1944 in France depended entirely on the supply system, and that the strength of the opposition of the Hitlerite armies played only a secondary role.

The present motorization and the continuously increasing complex technical material of modern armies, as well as the character of the envisioned actions, pose new and difficult tasks before the organs responsible for supply and services. Not only is the number of materials and utensils per capita becoming greater, but the speed of supply is also being conspicuously accelerated. Difficulties also stem from the necessity of maintaining a wide assortment of materials and utensils in mobile reserve. This pertains especially to spare parts for various technical equipment, the variety of which has steeply risen in recent times.

Both the structure of a modern army and its maintenance entail a relatively significant development of the sections of the rear services organs. To simplify this problem one could say that the numerical ratio of combat soldiers to soldiers either directly or indirectly responsible for safeguarding the battle is moving in favor of the latter. In passing, it should be mentioned that in connection with the development of modern long-range weapons, the dividing line between the combat soldier and the servicing soldier is becoming somewhat blurred, and that the criteria hitherto employed to distinguish one from the other are becoming more and more relative.

Selected at random, the above examples are nevertheless accumulating and require new organizational and technical solutions. A problem no less important than the realization of these tasks -- which is the responsibility of the organs supervising service and supply -- is the necessity of informing a wide segment of officers regarding the new tasks of the rear. This will be of help in train-

ing the soldier in executing tasks on the modern battlefield, and in instructing him in the basic problems of safeguarding the battle which decidedly affect its tempo, its course, and its results.

The purpose of the present article is to familiarize the reader with certain views on the problem of air supply. I should like to relate this discussion to the remarks made above concerning the servicing and supply of troops in modern warfare. Air transport belongs to those elements which make it possible for the units responsible for servicing and supply to execute their tasks in the most efficient manner.

We have long ago abandoned the view that air supply constitutes a very special and specific method of supply employed on rare and very exceptional occasions. The current view is that this form of supply is but one of many regular supply methods along with the methods of supply via automobile, rail and waterway. It is an exaggeration to say that the role of the air force will increase in importance. This is proved by the character of maneuvers in future military campaigns, the sudden changes in the combat situation, the possibility of an enemy destroying large areas through either radiation, or chemical warfare, or continuous assault with atomic weapons. The objects hit would include transportation arteries, junctions, and highway and railway bridges. In connection with this, a steadily increasing number of wounded, as well as more materiel, will be transported by air.

Naturally, in view of its sensitivity, costliness, and precision, air transport will be kept at a minimum. Whenever other methods of transportation are feasible, the use of air transport will be limited.

In general, it can be said that air transport will be used continuously along with other means of transportation, and that percentually it will vary according to requirements and feasibility of use. For instance, if it becomes possible to use automotive transportation, the share of air transport will be negligible, amounting to perhaps several percent of the total, or perhaps only a fraction of a percent. In other circumstances the proportion of air transport may be fairly large; in still other circumstances it may even be used exclusively -- that is, if other transportation methods are ruled out.

In any event, the conclusion is that air transport is a daily and continuous phenomenon in modern military operations. For this reason, its basic principles, its operating circumstances, and the most general facts concerning its technical aspects must be relayed to all line officers, as well as to supply units at the operative, tactical, and detachment levels.

Before discussing the details, I should like first to characterize the conditions under which air transportation can be used.

In air transportation it is possible to use fighter and transport planes, gliders and powered gliders, and helicopters, as well as, possibly in the future, transport rockets. From the point of view of methods of supply via air we may distinguish the following types of supply of materiel: via airplanes (gliders, etc.); via parachute drops; via stabilized drops (with small parachutes carrying the load in a perpendicular position); or even via drops without stabilizers, or put simply, by throwing well-packaged loads from airplanes.

This general breakdown of air transportation, as well as the methods of supply via air, is often cited in discussions on the subject of air transportation. There is a more varied and essential breakdown, however. It pertains to a certain combination of circumstances, that is: tactical circumstances, the quantity and type of load, the number and type of available transportation means. The tactical circumstances are decisive, and, depending on the military situation of the army, unit, or sub-unit, and the type and number of supplies and methods of supply, are accordingly described. It is only afterwards that we establish the means of supply of materiel (e.g. through landing or parachute drops).

The breakdown may be presented as follows:

I. Supplying the armies on one's own territory

- a. by landing
- b. without landing

II. Supplying the armies on enemy territory

- 1. Planned (contemplated)
 - a. by landing
 - b. without landing

2. Forced

III. Supplying diversionary or reconnaissance units on enemy territory

As can be seen, the tactical situation of supplying troops in any of the above-mentioned categories varies fundamentally.

In the first case we supply armies fighting under normal battle conditions on their own territory; in the second, troops fighting on enemy territory, the latter being subject to still further breakdown: e.g., planned situations (paratroop units deliberately dropped on

enemy territory, armored units engaged in raids deep inside enemy lines), and also forced situations (surrounded troops). Of course, one's own troops may be placed to defend certain points in the knowledge that they may be surrounded; however, in considering the whole problem this particular detail is not important. The important thing is to decide whether we should supply the division (or a larger number of them) a unit, or subunit, for it is this that decides the type of supply in advance -- as I shall try to prove in a subsequent part of this article.

The situation of subunits operating inside enemy lines (the third group) is unique and differs from the situation of troops fighting on enemy territory (second group) mainly in that these units operate in secrecy, which basically influences the method of their supply.

Now let us turn to a brief discussion of specific points raised above.

The Supply of Troops on One's Own Territory

The air supply of troops on one's own territory is an easier task than that of supply on enemy territory, for it requires fewer means and its form of organization is simpler. Of principal importance is the fact that the transportation is provided under conditions of relative safety, because:

it is not exposed to anti-aircraft fire or enemy infantry fire;

the activity of the enemy's pursuit planes is weaker in view of the presence of our own planes and anti-aircraft defense;

other factors endangering the safety of air transport will likewise be limited.

In addition, the transport planes work in constant coordination with their own radar and gun directors. Communication with assembly and base points should also, in principle, work without any hindrance.

The supply from the stores of army warehouses will be organized in principle by the front, and will be carried out between the front and the division. The principle method of delivering supplies will be by airplane (glider) at airports located close to the division supply points (DPZ). In terms of organization, this method is considerably simpler and more economical than that of airdrops, and for this reason it will be used most widely within our own territory.

If there are no airports near the DPZ lines, we can organize the supply with the help of transport helicopters. In this case the landing points may be closer to the combat troops. If this is un-

feasible (due to the lack, for instance, of helicopters), the supplies are delivered without landing, by means of air drops. The drops are carried out in the proximity of the DPZ line in accordance with accepted airline principles.

It should be noted that the supply of material in this manner may entail a number of unavoidable losses, and that the locating, carrying, or transporting of the dropped materials to the segregation points, as well as unpacking them, will entail a considerable exertion and number of means employed.

The Supply of Our Own Armies on Enemy Territory

In turning to the subject of supplying by air our own troops on enemy territory, it must be pointed out that this is a far more difficult process than supplying one's troops on one's own territory. The danger posed by the enemy's pursuit planes is considerably greater, as is that of rocket missiles. Furthermore, the flight to the point of supply, as well as the landing process, must be carried out amidst anti-aircraft fire and possibly even enemy submachine gun fire.

At certain times it will be necessary not only to provide cover for our transport planes being pursued by enemy aircraft, but also to hit the particularly active centers of enemy anti-aircraft fire located in the path of the planes, and also those units located close to the supply point.

There is a certain difference, however, between supplying paratroop units located on enemy territory and supplying units using various weapons and encircled or cut off by enemy forces.

Airborne operations are among those that must be carefully planned and prepared. In selecting the landing area, one must take into consideration the necessity of seizing the airport network for the purpose of organizing supply via landing airplanes, or at least of providing for suitable territory for large numbers of air drops. In addition, one of the most important prerequisites of landing operations is the concentration of such air forces as will enable at least a localized preponderance in the air during operations, thus providing the units responsible for air transport with a relative degree of safety.

An essential prerequisite is the advance planning and preparation, even as many as several days ahead, of all means of supply to be transported by air. It is likewise essential to synchronize carefully the types and amount of materials, landing equipment, and troops which will have to be transported at a later time -- either after executing the given tasks or in accordance with a calling signal.

The paratroop units have special supply cells trained to receive material and equipment transported by air.

All the above factors facilitate the air transport of supplies for paratroop units. At the same time, the operational landings may be supplied by landing planes.

In view of the limited tasks and the brief duration of the independent battles waged by paratroop units, it should, in principle, suffice to supply them simultaneously with material and subunits. At certain times, however, when the tempo of attack by our troops is slowed down, it may become necessary to resort to air drops. It is also possible that the operational landing detachment may execute its tasks earlier than expected and then unite with the troops. In that case the delivery of supplies will be undertaken on our own territory, in accordance with previously prepared methods.

Similar circumstances may arise in supplying armored units acting as advance detachments, or in supplying mobile units in the far rear of enemy lines. In this case, however, transporting supplies will be more difficult than in the case of a paratroop unit, because:

armored units do not have cells trained to receive air dropped supplies;

supply via landing planes will be a rather exceptional occurrence due to the organizational and technical difficulties entailed in the preparation of an airfield, as well as those arising from the speed of movement of armored units and the incomplete mopping up of the rear of enemy lines;

the supplies and products, as well as the wrapping, will not be especially suitable for air transport, in contrast to the materials and means organic to paratroop units.

Turning to the circumstances in which the organization of air supply to troops encircled on enemy territory will be undertaken, I should first like to concentrate on the difficulties involved.

To begin with, the terrain on which encirclement may occur is usually a wooded area, a defended point, or fortified and relatively inaccessible area (marshes, mountainous areas, etc.). Such areas do not afford suitable conditions for either landing supplies or air drops.

Secondly, the supplies of encircled combat units are usually heavily depleted, and the amount of any particular item may vary, and (especially if the rear units have been disorganized to some extent) may even be hard to inventory.

Thirdly, there may exist numerous organizational difficulties: landing strips or drop areas may not have been reconnoitred in advance; there may be insufficient servicing personnel; it may be necessary to

single out and, at times, even regroup the receiving units; difficulties may arise in communicating with the rear.

All this may force the supply cells at a given level to reorganize means of supply very quickly, sometimes even improvising being necessary.

Methods of Air Transportation Employed During Emergency Supply

Turning to the means of air transportation and the methods of delivering supplies, it should be emphasized that they will depend on the size of the encircled troops and the ground surface of the area occupied by them. If the isolated troops comprise an entire division -- or even two to three divisions -- the occupied area will comprise up to several hundred square kilometers, and generally will contain air-fields accessible to transport planes or gliders. An encircled area occupying only a few square kilometers will only under exceptional circumstances include an airfield. This airfield will, however, be within the range of enemy fire, hence unusable. This leaves only the air drop, and this often on unsuitable terrain. In addition, a detachment which possesses only its own supplies, these frequently dwindling, and has no access to the supplies of a division, will require new supplies under circumstances that are hardly favorable.

At the very least, supplying an encircled subunit is a difficult undertaking. The difficulties will become apparent already during attempts to establish contact, for the range of the radio stations at the disposal of the subunit may prevent any communication with the disposition centers in the rear. Furthermore, the limited area which a subunit can successfully defend does not afford the possibility of well-aimed drops by parachute.

This leaves only the possibility of stabilized drops from a low ceiling or drops without stabilizers. Under those circumstances, of course, even if the drops are well aimed, the more sensitive objects (e.g., ammunition) will become damaged, hence unusable.

It should be mentioned in this connection that a helicopter is not very suitable for these operations, in view of its limited speed, small range, and high susceptibility to infantry fire at a low ceiling and to anti-aircraft fire at higher altitudes.

Supplying Reconnaissance and Diversionary Groups

The fundamental principle in supplying reconnaissance and diversion groups is not to divulge their location. For this reason it will only

be on rare occasions that they will be supplied by landing planes; as a rule they will be serviced through parachute drops, and at night.

Since the load will as a rule not weigh much (in view of the size of the group), the best means of transporting it will be by fighter plane. This type of drop, especially far behind the enemy lines, is a difficult undertaking requiring great precision on the part of both suppliers and receivers.

In view of the lightness of the load, the special assortment, as well as the small number of drops, the supply will not be organized by the special supply cells of a given military unit, but rather by the units servicing the reconnaissance patrols.

Thus we have discussed in brief the most characteristic traits of air transportation in line with the points listed above.

The Organization of Air Transportation Organs

Now we should discuss one of the possible variants of how to organize the supply cells charged with the transportation of supplies by air. It seems to me that the most logical solution would be to have these cells attached to the permanent cells (detachments, departments, sections, etc.) which are responsible for other types of transportation. In this way we should achieve a certain coordination between air, railroad, automotive, and other types of transportation. It is clear that all the prerogatives at the disposal of the air forces command with respect to all airborne units (safety of flights, technical servicing) also apply to transport units.

In addition to the disposition centers (organization and planning), there must also be performing cells (supply and receipt), and these on several levels. On the operational level they could be attached to the commands of warehouses. At the level of division and the section, it would be desirable to instruct the field and defense units in this sphere. The sphere of activity of these cells would not be the same, e.g.:

1. We assume that on the operational level the receipt and dispatch of materiel and equipment would take place from supply air-fields and strips, with the servicing being carried out by the air force. The performing units would be responsible mainly for the distribution of materials, designation, delivery to the point of dispatch, the loading of supplies on airplanes in accordance with requirements, as well as the receipt of materials at airports -- that is, with unloading, sorting, unpacking and, at times, inspecting and re-addressing.

2. On the tactical level the presence of professional servicing troops of the air force will be rather an exception. The supply cells at that level will therefore have to be capable of:

- a) recognizing and selecting suitable terrain for landing or parachute drops;
- b) organizing the most imperative mopping up operations;
- c) indicating, in the manner required by the air force, the terrain for landing or air drops and assuring the right signal system;
- d) organizing the protection of airplanes and gliders while they remain on the airfield;
- e) organizing the observation of dropping areas and adjacent areas for the purpose of establishing the place where the loads hit the ground; organizing the transportation of the material to the sorting post and preparing the permanent containers for their return to the sender.

Other duties of the cells operating on the tactical level duplicate in principle those of the operational level.

In any case, the duties of the lower levels would seem to be considerably broader and more complex. It is understandable that many of the tasks described above, e.g., the cleaning up of the terrain and the transport of the containers, cannot be carried out by the supply services on their own. They will have to be aided by suitable forces; the supply cells will play mainly an instructional and organizational role.

Wrappings and Containers for Air Transportation

The discussion of this topic should begin by establishing which materials and equipment can be transported by air in the following element: Front -- army -- division -- detachment. Without going into detail then, regarding the carrying capacities of airplanes or gliders, the size of the compartments, etc., it should be stated that all basic types of supply can be transported by air.

In practice it is necessary to transport mostly ammunition, explosive materials, distilled fluids and greases, provisions, spare parts, medications, dressing materials, decontaminating and hygienic means, and, more rarely, uniforms, water, arms, and communication equipment.

The above items vary as to their weight, form, and size; they also differ in degree of sensitivity to hits and tremors, as well as in terms of concentration (solid bodies, fluids). Therefore it would make little sense to attempt to describe in detail wrapping and loading methods for them. Each packing, however, must meet the following requirements: compactness, resilience, sizes corresponding to the size of loading apertures, resistance to water, smooth surfaces without protruding bumps, a uniform color on the outside cover for the given article, means for facilitating transport by hand. In addition, the object to be dropped must be so protected against impact that it can escape damage.

It is desirable to place phosphorescent strips or geometrical figures in bright colors on the outside of the packages, so that they can easily be found both during the day and at night. If the objects to be dropped are placed in metal containers or in plastic containers, the above requirements no longer apply, inasmuch as the containers are already thoroughly equipped with them.

A most essential requirement is that of the correct loading of material into containers. The size of the materials must be in accord with the inside space of the containers. For instance, as regards the dropping of fluids, we must take into consideration:

- a) the dropping of a container that is simultaneously a vessel into which a fluid has been poured;
- b) the dropping of vessels (e.g., canisters) of considerable compactness, strength, etc., packed into groups of four and fastened with elastic bands;
- c) the dropping of a container filled with simple canisters; here the container affords the necessary protection, strength, etc.

Of materials capable of softening the force of impact we can mention rubber products, plastics of a spongy or foamy consistency, felt, plates made of papier-mache, and even combinations of straw and paper. Osier baskets also afford rather good protection. At times certain necessary articles may serve as protective material: for instance, cans may be wrapped in uniforms and underwear or medications may be wrapped in dressing materials.

In considering the two types of delivery by drop -- with or without containers -- it should be pointed out that the more economical method is that of dropping materials in their own packaging, for in dropping materials in containers we must take into account their possible loss and the possibility that they may not reach their destination due to various causes. Thus we quickly lose relatively expensive equipment. On the other hand, drops without containers incur greater

damage when they hit the ground.

To exhaust the subject of loading we should add that we must load not just one but several different types of supplies on a single airplane (glider). For example, in loading ammunition for anti-armor guns it must be assured that they do not all go on one single plane. In this way the loss of one airplane will not necessarily entail the complete loss of the supplies of one single product.

Evacuation by Air

I have thus far not touched upon the problem of air evacuation, so as to be able to discuss the transportation problem in greater detail. In organizing air transportation it is self-understood that as regards the landing of planes or gliders, the general principles regarding the utilization of returning empty transportation means must be taken into account.

Medical evacuation on division level can be executed with a limited number of means, evacuating those wounded and ill who require highly specialized medical care in front-line hospitals.

If sufficient transportation means are available, we send to the rear everyone except those who, in accordance with the instructions of the doctor, should remain at the divisional medical center. I shall avoid completely the question of medical evacuation via medical planes. This is a separate problem and thus does not fall within the scope of this article. The returning transportation means may also be utilized for technical evacuation -- mainly in the evacuation of especially important equipment or parts requiring repair in the rear. In this case the transportation of these items will be added to the tasks of the supply cells of a given level.

With this the scope of this article is, in principle, exhausted. I should merely like to remind the reader that the aim of this article has been to list a number of theses and propositions pertaining to the problem of air transportation in the sphere that may interest army leaders and the supply apparatus subordinated to them. I have completely avoided technical air problems, such as the type of transport planes or helicopters, their range, the size of loading compartments, the size of airfields or drop areas, the optimal altitudes for air drops, dispersement, etc.

Similarly, I have not touched upon problems of the air transportation of entire divisions or units, because they belong to a different category of transport.

Finally, a few conclusions:

1. The universality of air transportation makes it necessary that wide segments of commanding officers and officers of the supply apparatus be made familiar with this general subject.

2. Air supply under normal conditions should be introduced in training exercises as a daily matter in the following elements: Front-division (mainly airplanes), army-division (airplanes, helicopters), army-detachment, and even division-detachment (mainly helicopters).

3. During maneuvers it is desirable to create more frequently situations impelling the staffs to simulate the organization of the supply of troops on enemy territory.

4. During staff training exercises, the organization of disposition sections for air supply should be practiced; during army maneuvers, the same should apply with regard to dispatch and receiving groups.

INFANTRY TACTICS AND TRAINING ON AN ATOMIC BATTLEFIELD

[Following is a translation -- complete except for the first two paragraphs of the original -- of an article by Stanislaw Szulcynski in Przeglad wojsk ladowych (Land Troops Review), Vol I, No 5, November 1959, Warsaw, pages 36-46.]

In this article I should like to consider a number of theoretical problems regarding infantry tactics on an atomic battlefield and their implications as far as training is concerned. In discussing these problems I shall take into consideration the theories accepted heretofore and shall explain my attitude regarding them.

It has been correctly pointed out that in all fields of military science nuclear weapons give rise not only to quantitative changes but also to qualitative ones. In many cases these will not be limited solely to the improvement of the forms and methods of organization tested in the past, or to the conduct of battle. They will also make necessary the creation of completely new forms, and sometimes even new principles.

Following numerous publications, we shall repeat the most essential changes which have supposedly taken place in atomic-battlefield tactics.

The necessity for maximum exploitation of the results of our own atomic attacks, as well as the effort to avoid the results of the atomic attacks of the enemy, requires that movement and comprehensive maneuver be an inseparable element of all types of military operations, both offensive and defensive. Hence, for instance, the attack has to be led in most cases by marching at a very fast pace from the starting points located in the rear, sometimes (under favorable conditions) without rushing the infantry being transported in armored carriers.

In defense, too, the element of movement has assumed great importance. The main form of defense used heretofore -- stationary defense -- is, first of all, difficult to achieve because battle operations move unusually fast and rarely give sufficient time for the preparation of defense. Secondly, the heavy atomic blows of the enemy may with relative ease bring about a state of hastily prepared defense. Therefore defense will often take the form of a mobile one, the new principles of which have to operate no less potently than stationary defense did in the past.

Anti-atomic defense is the main element for the protection of combat troops. One of the most effective means of anti-atomic de-

fense is an even dispersal both in the regions of concentration and on the battlefield: hence, wider fronts of operations, gaps in battle grouping, open but protected wings, and also the ability for fast concentration, which will again be followed by fast and exact dispersal. This also includes such factors as the engineering preparation of the terrain, the maximum utilization of its protective features, the maximum utilization of armor, camouflage, uninterrupted contact with the enemy, etc.

Finally, we shall also mention other characteristic forms of modern warfare: the probability of frequent encounters and action after landing from the air or in battle with the enemy landing from the air.

It is clear that all such changes must be accompanied by the constant development of the motorization and mechanization of the troops, and also by a change in the forms of organization and armament, without which modern mobility is impossible.

Thus, any suggestions regarding infantry tactics and the process of training troops are derived from the most vital and universally recognized changes which were mentioned briefly above and which occur in tactics and not only in tactics.

The first fundamental suggestion already realized in all armies of the world is the total motorization of infantry. At the present time there are two well-known fundamental means of motorization of infantry: motor vehicles and armored troop-carriers. The latter are mostly present in armored units, sometimes also mechanized. Other units heretofore had only motor vehicles at their disposal.

Infantry tactics on the atomic battlefield are dependent on the means of motorization. It is impossible to speak of a uniform infantry and uniform infantry tactics. Infantry motorized by means of motor vehicles differs from the old infantry only in that it does not travel on foot when not in contact with the enemy. In other words, the motor vehicle is its means of transportation. Instead, in direct combat with the enemy the infantry then operates on foot, mostly in the traditional grouping or battle order.

It is a different matter with infantry equipped with armored troop-carriers. A troop-carrier is both a means of transportation and, under certain conditions, a means of combat. From an armored troop-carrier the infantry is able to engage in direct combat with the enemy, keeping pace with the tanks. The genuinely mobile character of combat operations is apparent when the infantry operates with armored troop-carriers. However, this does not mean that infantry furnished with armored troop-carriers will always fight from these vehicles, or that there will never be any operations on foot. It appears that op-

erations on foot will constitute a rather frequent, if not the most common, event. When it is necessary to overcome strong enemy resistance, operations on foot will probably be the rule. On the other hand, the overcoming of weaker enemy resistance will be accomplished mostly from troop-carriers without the infantrymen dismounting.

The quality of the armored troop-carriers determines the possibility of infantry action without dismounting. There are various types of troop-carriers. Each has its defects and advantages. The observation of many exercises makes it possible to formulate the following requirements.

A troop-carrier for the infantry must be capable of mobility on every kind of terrain and under every kind of condition; it must be able to accompany tanks at any time and at any place. This is necessary because modern operations, especially of an offensive nature, are conducted as common efforts mainly by infantrymen and tank men, whose coordination is essential.

The fact that the troop-carrier must be constructed after the tank model does not mean -- as is sometimes maintained -- that it must necessarily be of the caterpillar type. If it were possible to construct a wheeled carrier with more or less the same potentialities for mobility over rough terrain as tanks, this would probably be both better and cheaper.

A troop-carrier is not designed for the accommodation of a very large number of men. A troop-carrier for a platoon is not, in my opinion, very suitable as regards fighting from it. In modern warfare an assault company on a front of about 500 meters would have altogether three troop-carriers which would have to operate at a distance of at least 150-200 meters from one another. Such grouping creates better conditions as regards safety but reduces the potentialities for efficacious attack on the enemy. Even the conditions of safety are not ideal, because one well-aimed projectile can hit a troop-carrier and its entire platoon. At best, it appears that a troop-carrier is suitable for a section or a squad.

A troop-carrier must be well armed. Possession of two stationary manual machine guns, one being capable of anti-aircraft fire, or one of a general-purpose character, is probably most appropriate.

Finally, the armor of the troop-carrier must provide sufficient protection for the crew against enemy fire -- at least against armor-piercing rifle fire and the fragments of artillery projectiles -- while at the same time not restricting the mobility of the carrier.

In the field of the designing of armored troop-carriers the engineers still have a large area in which to prove themselves. It is to be presumed that the fruits of their labor will become more apparent. It is necessary to strive for this in order that the troop-carrier and its armor under certain conditions may furnish protection against atomic weapons. That will be its greatest advantage.

From the above it is clear that there now exist two kinds of infantry: that using motor vehicles and that using armored troop-carriers. In view of the different capabilities and attributes of these means of motorization, their tactical potentialities are likewise different.

In approaching a resisting enemy, infantrymen mounted on motor vehicles dismount and disperse in a skirmishing attack in foot formation. The tanks assisting the infantrymen, although cooperating with them fully, are not able to detach themselves very much. Their operations at that time will be traditional, that is, direct support of the infantry. True, one hears it said that tanks should not be limited to covering the infantry but should operate separately from it, especially in the course of an atomic attack. Personally, I am not inclined to agree that this is a correct view, because in any place where the effects of an atomic attack have abated, the tanks, finding themselves far from the infantry, may become easy prey to the enemy. Rather it is necessary to seek a different solution, namely: in the event of an atomic attack, armored units would operate in which tanks would be the chief striking force, while the infantry -- in armored troop-carriers, of course -- would assist the tanks in combat, keeping pace with them. If, however, the basic force is infantry, then it would operate from armored troop-carriers. The tactics of the latter differ from the tactics of infantry mounted in motor vehicles in that under certain conditions (the attack being organized defensively on the spot, following a heavy atomic attack on the frontal edge) the infantry does not dismount but advances with the carriers in the gaps behind and between the tanks or sometimes in front of them, conducting heavy fire from the troop-carriers.

In my opinion, in the training process one should take into account both methods of infantry action in an attack without giving preference to either of them.

The foregoing suggestion seems to me to be especially important because many publications in the last 2 or 3 years have given an obviously one-sided picture of the battlefield of the future. For example, in a discussion some time ago in the military press, certain disputants, in their zeal to combat deeply rooted concepts, did not avoid presenting a one-sided picture of future military operations. According to them, the attack will be such that movement

will occur in different directions when atomic "mushrooms" appear, military units being mounted in tank and carrier armor, supported of course by rockets and pursuit planes.

I have nothing against such a view of the future battlefield, provided it be one of possible variants occurring only here and there under particularly favorable circumstances, especially under conditions of absolute superiority over the enemy. If, instead, it represents the sole or even a partial picture of the battlefield of the future, then my imagination cannot accept it. It is not because my imagination has become imbued with a "suggestive picture of the battlefield" at the front in the last war, but because it envisages varied conditions. These conditions are first of all counterattacks by an enemy that likewise has powerful means of warfare, as well as the fact that atomic weapons will not be used on a mass scale always and everywhere.

Of course one should realize that in a heated discussion there may be exaggerations of some problems. Such exaggerations may even be intentional if they serve a definite purpose. However, certain observations of the process of training prove that one-sided pictures of the battlefield have been so conceived -- possibly contrary to the intentions of their authors -- that the necessity for considering other conditions and training corresponding to such conditions is completely overlooked. I, therefore, wish to point out that the opinion involving solely the concept of military units mounted in tanks and carrier armor advancing in the direction of gigantic atomic "mushrooms" may become a concept no less damaging than the deeply rooted concepts which do not permit one to see the changes that are occurring. In this connection, I should like to express the conviction that in a bold and decisive tendency towards changes arising from the character of the modern battlefield it is not permissible to throw overboard "old" experiences.

Incidentally, one should direct attention to still another matter. It is known everywhere that atomic "mushrooms" and perhaps thermonuclear weapons cause enormous destruction, and that such destruction will also strike military equipment. We, therefore, conceive that at a given moment, as a result of immediate destruction and the disruption of communications, there may be a simple lack of sufficient armor and even ordinary motor vehicles. How will the infantry fight then? Doubtless by infantry deployment supported by a small number of tanks, and in such a case the "old" experience will certainly come into play.

Let us turn now to the discussion of certain problems of the tactics of infantry subunits on the atomic battlefield.

One of the recognized changes in offensive operations is the attack conducted from deep in one's own military grouping. Are sub-units involved? Of course they are. In one of my articles I tried to clarify my views as to the nature of battalion and company attack from starting bases situated deep in one's own grouping. It follows from this that the battalion, the company, and even the platoon situated in the second echelon of its unit or subunit may often start attack from the second line, but that the features of this attack will end while the main attack is beginning. From this moment on the action develops normally according to generally accepted principles.

In my opinion, in conducting the attack from the depth of one's grouping to the proper stage, one must still recognize the difficulties of its execution, which requires that much attention be given to this subject in the process of training troops.

It is necessary thus to study swift movements -- motorized and on foot. On foot, because subunits such as the platoon or company advancing to the attack from another echelon of the main unit, will find themselves too close to the line of attack to make the shift advantageously with their means of transport, unless such means are in the form of armored carriers from which the battle can be carried on.

It is necessary to give much attention to the skills of disengaging units and deployment for battle in order to achieve the desirable battle array or military grouping in movement and not waste time in attacking the enemy. Important here is skill in bypassing friendly subunits stationed in immediate contact with the enemy and not intended for attack in the first echelon. Especially important here is the proper organization and utilization of such a system of fire coordination as will ensure maximum fire support of the subunits not attacking, in favor of the subunits fighting in the first echelon. This problem is likewise essential from the standpoint of ensuring maximum fire support, as well as the security of those being supported.

In defensive operations, stationary defense -- as it is everywhere considered, and rightly so -- is not a single all-prevailing form of defense. Much attention has recently been given to mobile defense. However, it is once again important to stress the fact that mobile defense is not of much concern to the subunits and units. Modern mobile defense is likewise rarely used by "pure" infantry. Its strength lies in mobility and attack supported by heavy firepower, atomic fire above all. In my opinion, the appearance of mobile defense as a new form of defense should not have any vital influence on the tactical training of infantry subunits.

In mobile defense all infantry subunits execute a general mission, but each subunit does not individually see the changing features of this action. For it each defense is stationary because its purpose is to inflict upon the enemy maximum losses, break its attack, and maintain a defensive position. Without orders from above it is not free to leave this position. Therefore in a delaying action (one of the elements of mobile defense) it will receive orders to leave a defensive position and take up another rather often, but this does not change the character of each defense from designated positions.

Another element of mobile defense is stationary defense. It is therefore understandable that the tactics of infantry subunits is of the more traditional type. "Not one step backwards without orders from above," is the unchanging principle.

A third element of mobile defense is the attack. For the infantry subunits in combat, the action is solely offensive action.

From the foregoing it follows that as regards the defensive operations of the infantry subunits, according to their role, one must study first of all the forms of stationary defense, and therefore such forms as the conditions and peculiarities of the terrain, as well as firepower, inflicting upon the attacking enemy the maximum losses, breaking its attack, and maintaining a defensive position as long as the commanding officer so orders. At the same time, proper disengagement from the enemy and from the battle must be studied. These forms may be applied in all types of battle (defense, attack, retreat). They likewise existed before the advent of mobile defense. Their rules were foreseen. However, little consideration has been given to them in the training process. The recognition of mobile defense as one of the forms of defensive operations has made it necessary to train troops from every angle.

On the atomic battlefield of the future there can be no excessive concentration of masses of troops or technical military equipment. The enemy will probably detect every larger concentration and destroy it by atomic means. Hence, dispersal will undoubtedly be far advanced. But how far? For there can be dispersal without end. But what is advantageous to the interests of the military missions that have been executed?

There are many opinions on this question. All agree that dispersal cannot be carried out in the case of a lower echelon used for the execution of relatively independent military missions. Instead, the views vary as to the unit.

It seems to me that the unit best capable of executing small missions is the platoon. It is the most mobile unit and can be easily dispersed.

military missions is the battalion. Properly reinforced and supported, with a certain detachment from neighboring units, it can independently destroy the enemy's central opposition point and develop an attack in depth; while awaiting greater support or counter-attack, it can sustain pressure until reinforcements arrive from the rear or from some other direction. In defense, the battalion can independently defend a zone the size of which makes it possible to organize a strong circular defense. The only danger for a battalion operating independently is a direct atomic attack of at least average caliber, able to eliminate it completely from the battle. A wide dispersal of the battalion may ensure better conditions for anti-atomic defense and protect it from destruction by a single direct atomic attack of average caliber. However, an overly dispersed battalion will not be in a position to execute an average military mission. For dispersal leads to expansion of the action fronts, and these must be adjusted to the size of the forces and the means which one's own troops, as well as the enemy, have available.

The presently accepted rules for the battalion action front are within the limits of judgment, which indicates that they are maximal from the standpoint of the possibility of executing the average military mission. They are, as we know, considerably broader than those applied under pre-atomic conditions. They may be complied with through assuring somewhat greater distances between soldiers, which has already been adopted from the experiences of the last war, and through maintaining reasonable gaps between the subunits of the battalion. Greater dispersal of the battalion does not seem possible if conditions are to be maintained for executing military missions.

The foregoing involves the question of gaps and flanks. From the standpoint of anti-atomic defense the gap plays a vital role only when sufficiently large (about 2 km). Such gaps may be used only between units capable of independent action. It is therefore proper to employ them between detachments and sometimes between battalions. Further dispersal of the battalion in battle is likewise excluded.

Large gaps lead to operations with open flanks. Such operations are possible today, but they cannot be used too freely. The higher officer ordering such operations must cover them adequately with firepower and diversionary attacks.

At the same time, the operations are continuous, and one of the elements of continuity is the conduct of operations without interruption day and night. Therefore, much attention has recently been given to night operations. In the military publications, however, it is possible to note a certain one-sidedness in dealing with this problem. The gist of the matter is that night operations are carried out on a big operational scale, and also under conditions approximating daytime

operations, use being made of various means of illuminating the battlefield, making possible the almost normal use of all kinds of troops. The main feature in conducting this kind of night operations is the intelligent use of various means of illumination.

It seems, however, that in training troops for night operations one must not overlook other previously used tactical methods, especially when it is a question of subunits. It may often be possible to conduct a night attack with a limited objective and small forces. The objective of such an attack may be reconnaissance, improving the situation, capturing a resistance point which could not be captured by day, taking prisoners, etc. In such cases it is extremely important to surprise the enemy by a sudden and violent attack. Experience in the last war shows that the so-called "silent attack" (viz: a small unit advances noiselessly to the nearest possible position of the enemy and attacks point-blank, opening fire immediately in response to enemy fire) yields very positive results. Let us take as an example the action of two units of three infantry divisions above Pilice in the vicinity of the village of Ostrolek on 1 September 1944. This action resulted in the capture of many prisoners, including a Hitlerite captain with valuable documents, although it was necessary to force the river on both sides.

There follows from this an important element in the tactical training of infantry subunits: in addition to modern forms of night attack made within the framework of a bigger unit, study of the traditional forms of night attack, "silent attack," surprise attack.

Among the characteristic forms of action on the modern battlefield, the actions of air-landing forces are often mentioned. In consequence, a significant development of air-landing forces is to be observed in all the armies of the world. These detachments and combinations of air-landing forces are intended chiefly for carrying out missions on a large scale, in most cases deep in the rear of the enemy. However, on the modern field of battle there are many small but important missions that could be accomplished with the help of air-landed or parachuted forces at shallow depths inside the enemy grouping. Are special single units of air-landing forces sufficient for this?

It may be possible to answer, without complicated reasoning, that they are not sufficient. It is necessary for such missions to utilize subunits of infantry. I think this will not arouse any contradiction, being confirmed by numerous statements in various military publications. However, after accepting the theoretical thesis, there must follow a consistent realization of this in the training process. This means that ordinary infantry should be systematically trained in the sphere of the operations of air-landing forces in all

possible forms. In all troop exercises whose plan includes the air-landing of forces, it is not necessary to seek the help of specialists from detachments of the air-landing forces. Above all, this must apply to forces air-landed from helicopters.

Another problem which, in my opinion, has not yet been sufficiently appreciated is reconnaissance. Specialists are not giving full attention to this problem. However, it is well known that, everywhere and almost continually, reconnaissance operations are not limited to specialists alone.

Reconnaissance must be conducted by everybody, everywhere. Nonobservance of this requirement can bring about very grave consequences in war. To be convinced of this, even a superficial knowledge of the history of military operations in the last war suffices. In the process of training infantry, the problems of battle reconnaissance accomplished by various methods and under varied circumstances must be broadly taken into account.

As follows from the discussion we had so far, infantry embraces all types of troops. We shall not discuss, however, all elements of that comprehensiveness, because they were very detailedly described in other articles in Przeglad wojsk ladowych [Land Troops Review]. The point is that a modern infantryman must possess elementary knowledge of field engineering, chemistry, and communications, because it is impossible in all cases to expect an engineer to lay or remove a mine or under ordinary conditions a chemist to decontaminate terrain, or a communications expert to attend a radio station -- work which is done by the lowest links in the command, and which tomorrow may be done by the individual soldier. Everything must be a matter of intensive study, of course.

In conclusion, a few words about the criterion for evaluating the level of the tactical training of the infantry subunit.

Experience shows that the evaluation of tactical actions entails great difficulties. It has been said that in contrast to other elements (fire training, drilling, etc.), the deficiency is to be found in tangible preliminary elements which can be expressed in numbers. Visual effect is very often decisive in the evaluation of tactical action, but the auditory effect comes before everything. Knowledge of it is evaluated, and thus an effort is made, particularly at inspection time, to accumulate as many visual signs as possible from tactical actions.

It seems that a proper understanding of the nature of the tactics of an infantry subunit must completely overcome the difficulties of finding a criterion for the evaluation of the level of tactical training. Proceeding from the assumption that the infantry is very comprehensive as regards troop types and that this comprehensiveness is clearly to be noted in tactics, it is necessary to study, during the control action, the degree of attainment of that comprehensiveness.

It is therefore necessary to verify the degree to which the individual soldier of the subunit (with regard to small subunits) has mastered all the elements of comprehensive tactical training, the selection and preparation of the fire position, the ability to direct fire in a concrete tactical situation, the ability to advance over difficult terrain (marching, running, crawling, the overcoming of obstacles, etc.), the ability to camouflage, the use of means of antichemical defense, the directing of observations, etc. -- all of course in accordance with a definite tactical pattern. In accordance with this pattern, the intelligently integrated regular action of all the aforementioned elements bears witness to the high level of the tactical training of the infantry subunit.

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FIGURE APPENDIX

Graph showing the relationship between Roentgen doses and distance from the place of explosion. The graph shows that Roentgen doses decrease as the distance from the explosion increases.

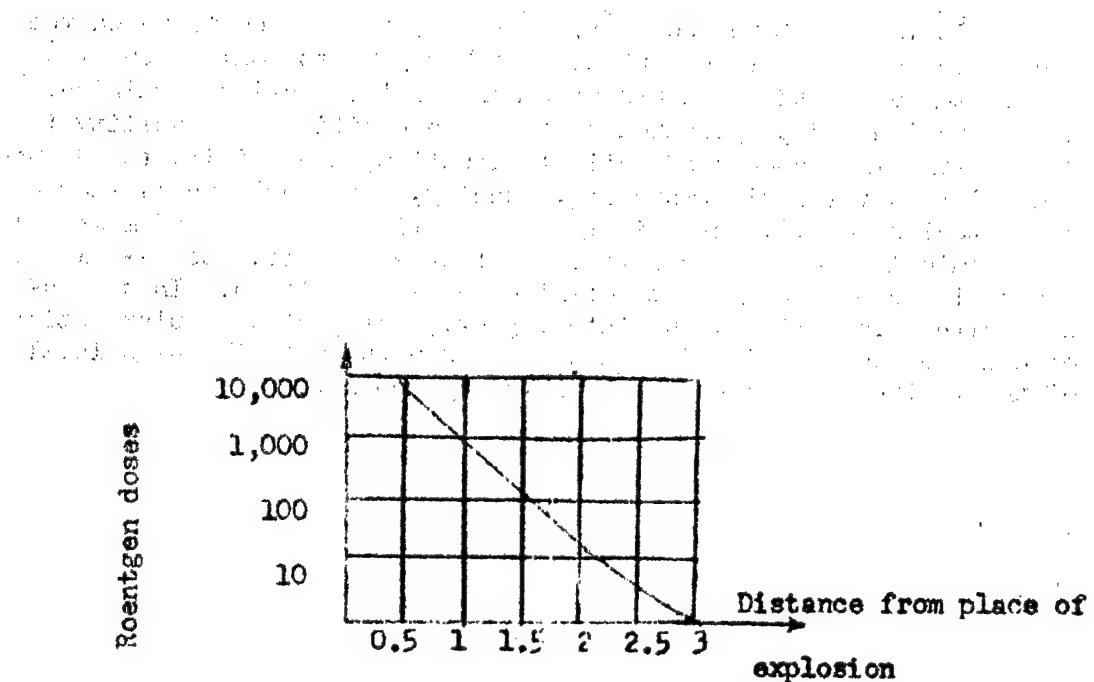


Fig 1

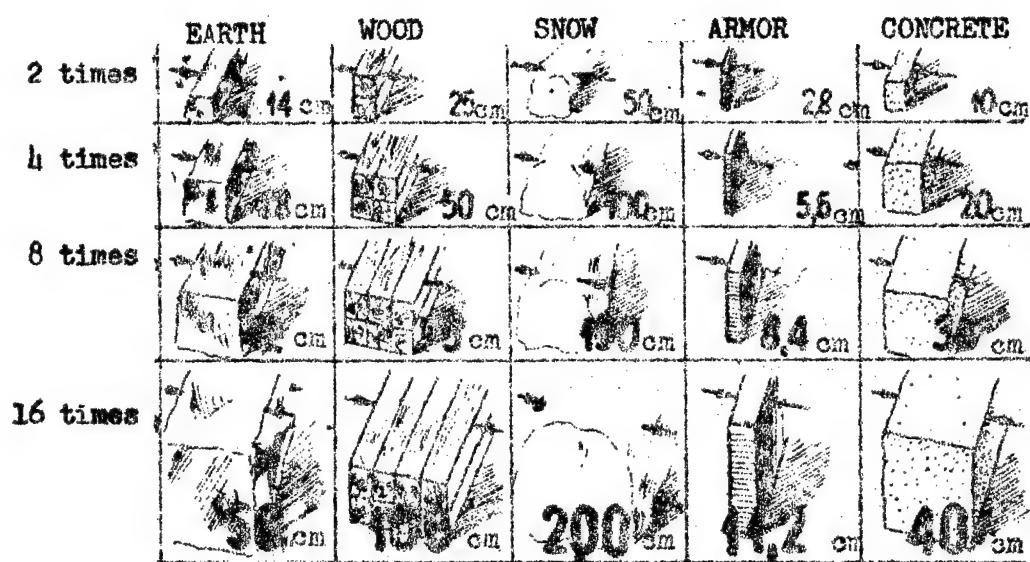


Fig 2

SIZE OF LOSSES
DISPERSED AIM

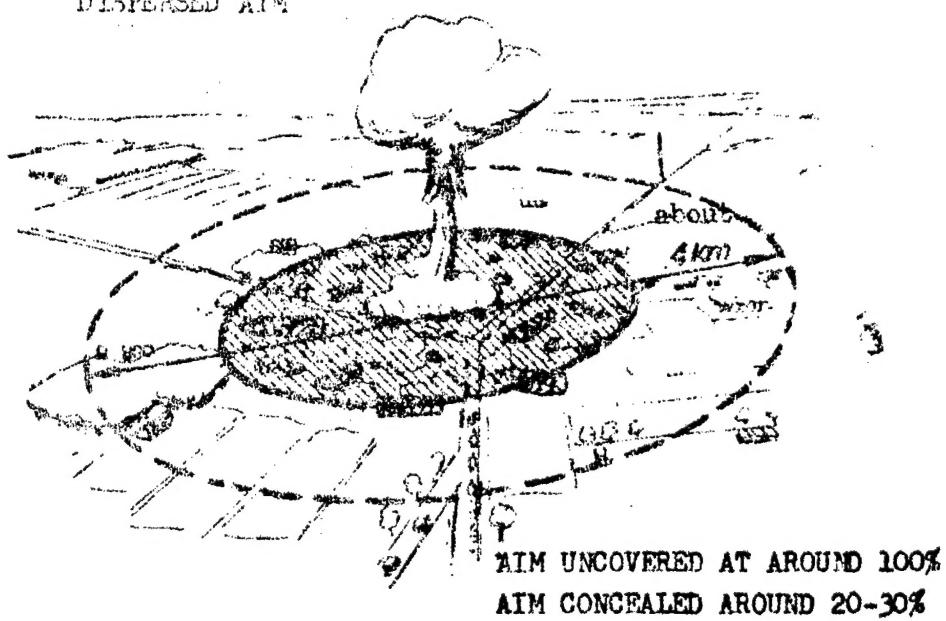


Fig 3

EXTENT OF LOSSES

Aim uncovered around 20%
Aim concealed around 5%

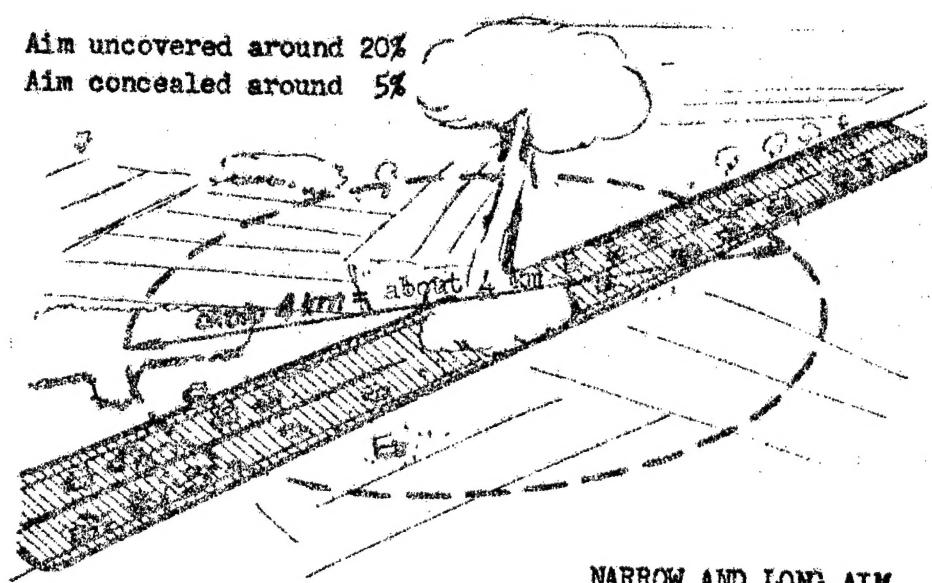


Fig 4

EXTENT OF LOSSES

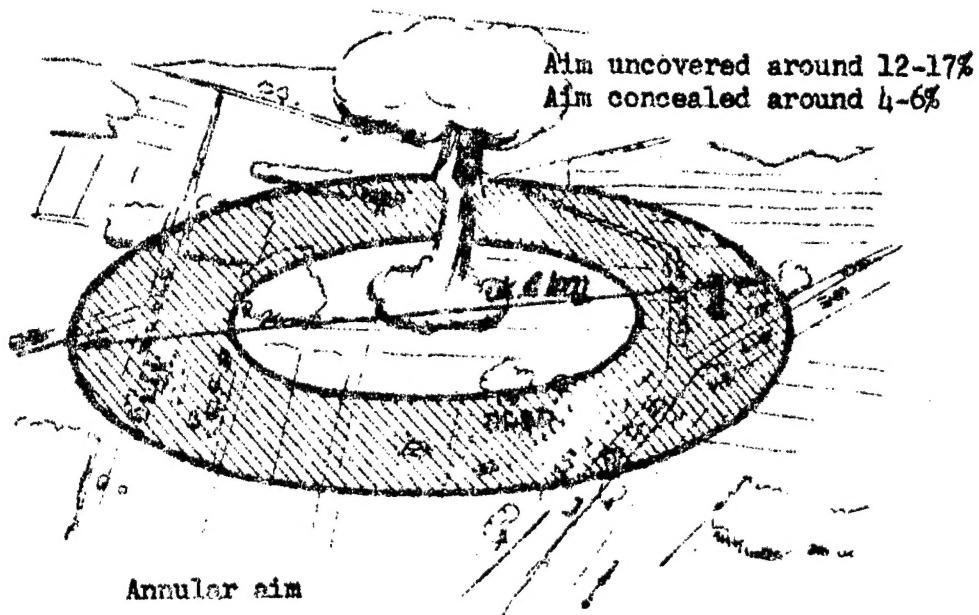


Fig 5

EXTENT OF LOSSES

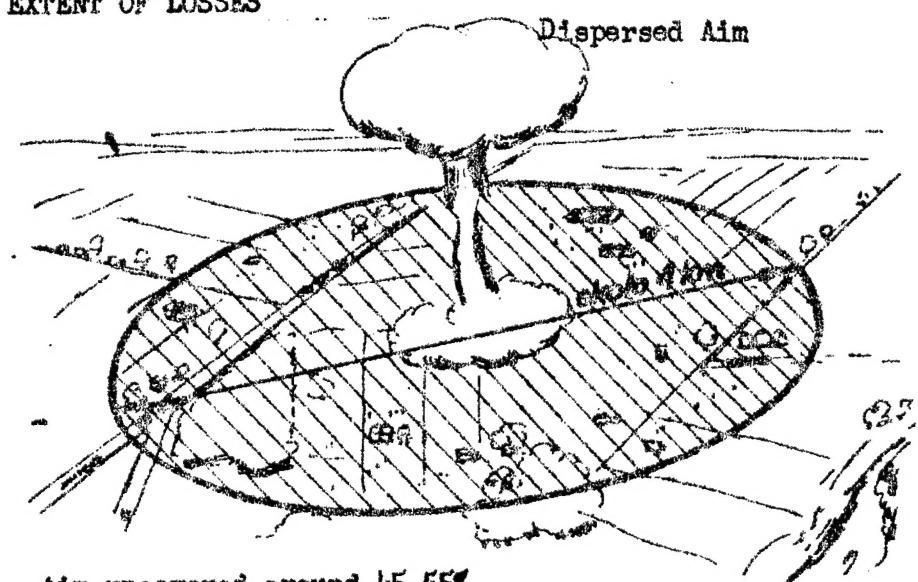


Fig 6